

# LMV341-Q1, LMV344-Q1 Rail-to-Rail Output CMOS Operational Amplifiers

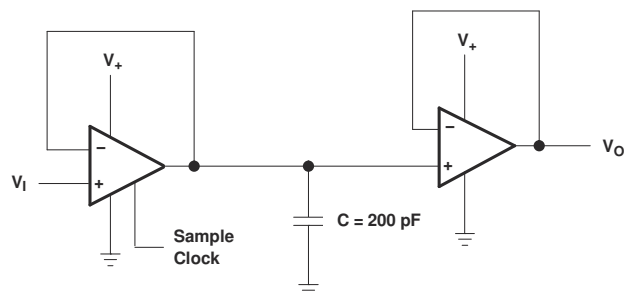
## 1 Features

- Qualified for Automotive Applications
- 2.7V and 5V Performance
- Rail-to-Rail Output Swing
- Input Bias Current: 1pA typical
- Input Offset Voltage: 0.25mV typical
- Low Supply Current: 100µA typical
- Gain Bandwidth: 1MHz typical
- Slew Rate: 1V/µs typical
- Turn-On Time From Shutdown: 5µs typical
- Input Referred Voltage Noise (at 10kHz): 20nV/√Hz

## 2 Description

The LMV341 and LMV344 devices are single and quad CMOS operational amplifiers, respectively, with low voltage, low power, and rail-to-rail output swing capabilities. The PMOS input stage offers an ultra-low input bias current of 1pA (typical) and an offset voltage of 0.25mV (typical). The single supply amplifier is designed specifically for low-voltage (2.7V to 5V) operation, with a wide common-mode input voltage range that typically extends from –0.2V to 0.8V from the positive supply rail. Additional features are a 20nV/√Hz voltage noise at 10kHz, 1MHz unity-gain bandwidth, 1V/µs slew rate, and 100µA current consumption per channel.

An extended industrial temperature range from –40°C to 125°C makes this device an excellent choice for automotive applications.



**Application Circuit: Sample-and-Hold Circuit**



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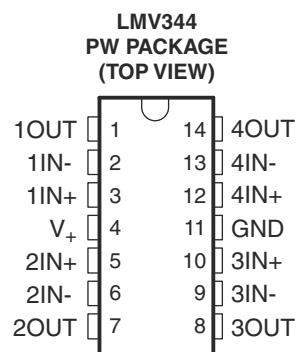
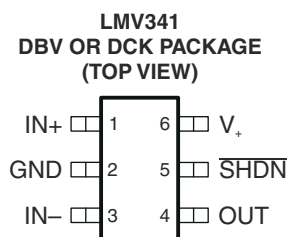
### 3 Device Comparison Table

(1)

| T <sub>A</sub> | PACKAGE <sup>(2)</sup> |              | ORDERABLE PART NUMBER | TOP-SIDE MARKING <sup>(3)</sup> |
|----------------|------------------------|--------------|-----------------------|---------------------------------|
| –40°C to 125°C | SC-70 – DCK            | Reel of 3000 | LMV341QDCKRQ1         | RR_                             |
|                | SOT-23 – DBV           | Reel of 3000 | LMV341QDBVRQ1         | RCH_                            |
|                | TSSOP – PW             | Reel of 2000 | LMV344IPWRQ1          | LMV344Q                         |

- (1) For the most current package and ordering information, see the Package Option Addendum at the end of this document, or see the TI web site at [www.ti.com](http://www.ti.com).
- (2) Package drawings, thermal data, and symbolization are available at [www.ti.com/packaging](http://www.ti.com/packaging).
- (3) DBV/DCK: The actual top-side marking has one additional character that designates the wafer fab/assembly site.

## 4 Pin Configuration and Functions



## 5 Specifications

### 5.1 Absolute Maximum Ratings

(1)

over operating free-air temperature range (unless otherwise noted)

|                  |                                              |             |                |
|------------------|----------------------------------------------|-------------|----------------|
| V <sub>+</sub>   | Supply voltage <sup>(2)</sup>                |             | 5.5V           |
| V <sub>ID</sub>  | Differential input voltage <sup>(3)</sup>    |             | ±5.5V          |
| V <sub>I</sub>   | Input voltage range (either input)           |             | 0 to 5.5V      |
| θ <sub>JA</sub>  | Package thermal impedance <sup>(4) (5)</sup> | DBV package | 165°C/W        |
|                  |                                              | DCK package | 259°C/W        |
|                  |                                              | PW package  | 113°C/W        |
| T <sub>J</sub>   | Operating virtual junction temperature       |             | 150°C          |
| T <sub>stg</sub> | Storage temperature range                    |             | –65°C to 150°C |

- (1) Stresses beyond those listed under "absolute maximum ratings" may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated under "recommended operating conditions" is not implied. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability.
- (2) All voltage values (except differential voltages and V<sub>+</sub> specified for the measurement of I<sub>OS</sub>) are with respect to the network GND.
- (3) Differential voltages are at IN+ with respect to IN–.
- (4) Maximum power dissipation is a function of T<sub>J(max)</sub>, θ<sub>JA</sub>, and T<sub>A</sub>. The maximum allowable power dissipation at any allowable ambient temperature is P<sub>D</sub> = (T<sub>J(max)</sub> – T<sub>A</sub>)/θ<sub>JA</sub>. Operating at the absolute maximum T<sub>J</sub> of 150°C can affect reliability.
- (5) The package thermal impedance is calculated in accordance with JESD 51-7.

### 5.2 Recommended Operating Conditions

|                                                         | MIN | MAX | UNIT |
|---------------------------------------------------------|-----|-----|------|
| V <sub>+</sub> Supply voltage (single-supply operation) | 2.5 | 5.5 | V    |
| T <sub>A</sub> Operating free-air temperature           | –40 | 125 | °C   |

### 5.3 ESD Ratings

| TEST CONDITIONS        | TYP  | UNIT |
|------------------------|------|------|
| Human-Body Model (HBM) | 2000 | V    |
| Machine Model (MM)     | 200  | V    |

## 5.4 Electrical Characteristics 2.7V

$V_+ = 2.7V$ ,  $GND = 0V$ ,  $V_{IC} = V_O = V_+/2$ ,  $R_L > 1M\Omega$  (unless otherwise noted)

| PARAMETER        |                                                         | TEST CONDITIONS                                                                         |            | T <sub>A</sub> | LMV341 |                    |     | LMV344 |                    |     | UNIT    |
|------------------|---------------------------------------------------------|-----------------------------------------------------------------------------------------|------------|----------------|--------|--------------------|-----|--------|--------------------|-----|---------|
|                  |                                                         |                                                                                         |            |                | MIN    | TYP <sup>(1)</sup> | MAX | MIN    | TYP <sup>(1)</sup> | MAX |         |
| V <sub>IO</sub>  | Input offset voltage                                    |                                                                                         |            | 25°C           | 0.25   |                    | 4   | 0.25   |                    | 4   | mV      |
|                  |                                                         |                                                                                         |            | Full range     |        | 4.5                |     | 4.5    |                    |     |         |
| α <sub>VIO</sub> | Average temperature coefficient of input offset voltage |                                                                                         |            | Full range     | 1.7    |                    |     | 1.7    |                    |     | μV/°C   |
| I <sub>IB</sub>  | Input bias current                                      |                                                                                         |            | 25°C           | 1      | 120                |     | 1      | 120                |     | pA      |
|                  |                                                         |                                                                                         |            | –40°C to 85°C  |        | 250                |     | 250    |                    |     |         |
|                  |                                                         |                                                                                         |            | –40°C to 125°C |        | 3                  |     | 3      |                    | nA  |         |
| I <sub>IO</sub>  | Input offset current                                    |                                                                                         |            | 25°C           | 6.6    |                    |     | 6.6    |                    |     | fA      |
| CMRR             | Common-mode rejection ratio                             | 0 ≤ V <sub>ICR</sub> ≤ 1.7V                                                             |            | 25°C           | 40     | 80                 |     | 56     | 80                 |     | dB      |
|                  |                                                         | 0 ≤ V <sub>ICR</sub> ≤ 1.6V                                                             |            | Full range     | 36     |                    |     | 50     |                    |     |         |
| k <sub>SVR</sub> | Supply-voltage rejection ratio                          | 2.7V ≤ V <sub>+</sub> ≤ 5V                                                              |            | 25°C           | 45     | 82                 |     | 65     | 82                 |     | dB      |
|                  |                                                         |                                                                                         |            | Full range     | 60     |                    |     | 60     |                    |     |         |
| V <sub>ICR</sub> | Common-mode input voltage range                         | CMRR ≥ 50dB                                                                             |            | 25°C           | 0      | –0.2 to 1.9        | 1.7 | 0      | –0.2 to 1.9        | 1.7 | V       |
| A <sub>V</sub>   | Large-signal voltage gain <sup>(2)</sup>                | R <sub>L</sub> = 10kΩ to 1.35V                                                          |            | 25°C           | 73     | 113                |     | 78     | 113                |     | dB      |
|                  |                                                         |                                                                                         |            | Full range     | 66     |                    |     | 70     |                    |     |         |
|                  |                                                         | R <sub>L</sub> = 2kΩ to 1.35V                                                           |            | 25°C           | 70     | 103                |     | 72     | 103                |     |         |
|                  |                                                         |                                                                                         |            | Full range     | 63     |                    |     | 64     |                    |     |         |
| V <sub>O</sub>   | Output swing (delta from supply rails)                  | R <sub>L</sub> = 2kΩ to 1.35V                                                           | Low level  | 25°C           | 24     |                    | 60  | 24     |                    | 60  | mV      |
|                  |                                                         |                                                                                         |            | Full range     | 95     |                    | 95  |        |                    |     |         |
|                  |                                                         |                                                                                         | High level | 25°C           | 26     |                    | 60  | 26     |                    | 60  |         |
|                  |                                                         |                                                                                         |            | Full range     | 95     |                    | 95  |        |                    |     |         |
|                  |                                                         | R <sub>L</sub> = 10kΩ to 1.35V                                                          | Low level  | 25°C           | 5      |                    | 30  | 5      |                    | 30  |         |
|                  |                                                         |                                                                                         |            | Full range     | 40     |                    | 40  |        |                    |     |         |
|                  |                                                         |                                                                                         | High level | 25°C           | 5.3    |                    | 30  | 5.3    |                    | 30  |         |
|                  |                                                         |                                                                                         |            | Full range     | 40     |                    | 40  |        |                    |     |         |
| I <sub>CC</sub>  | Supply current (per channel)                            |                                                                                         |            | 25°C           | 100    | 170                | 150 |        | 200                | μA  |         |
|                  |                                                         |                                                                                         |            | Full range     | 230    |                    | 230 |        |                    |     |         |
| I <sub>OS</sub>  | Output short- circuit current                           | Sourcing                                                                                |            | 25°C           | 20     | 32                 |     | 18     | 24                 | mA  |         |
|                  |                                                         | Sinking                                                                                 |            |                | 15     | 24                 |     | 15     | 24                 |     |         |
| SR               | Slew rate                                               | R <sub>L</sub> = 10kΩ <sup>(3)</sup>                                                    |            | 25°C           | 1      |                    |     | 1      |                    |     | V/μs    |
| GBM              | Unity-gain bandwidth                                    | R <sub>L</sub> = 10kΩ, C <sub>L</sub> = 200pF                                           |            | 25°C           | 1      |                    |     | 1      |                    |     | MHz     |
| Φ <sub>m</sub>   | Phase margin                                            | R <sub>L</sub> = 100kΩ                                                                  |            | 25°C           | 72     |                    |     | 72     |                    |     | deg     |
| G <sub>m</sub>   | Gain margin                                             | R <sub>L</sub> = 100kΩ                                                                  |            | 25°C           | 20     |                    |     | 20     |                    |     | dB      |
| V <sub>n</sub>   | Equivalent input noise voltage                          | f = 1kHz                                                                                |            | 25°C           | 40     |                    |     | 40     |                    |     | nV/√ Hz |
| I <sub>n</sub>   | Equivalent input noise current                          | f = 1kHz                                                                                |            | 25°C           | 0.001  |                    |     | 0.001  |                    |     | pA/√ Hz |
| THD              | Total harmonic distortion                               | f = 1kHz, A <sub>V</sub> = 1, R <sub>L</sub> = 600Ω, V <sub>I</sub> = 1 V <sub>PP</sub> |            | 25°C           | 0.017  |                    |     | 0.017  |                    |     | %       |

(1) Typical values represent the most likely parametric norm.

(2)  $GND + 0.2V \leq V_O \leq V_+ - 0.2V$

(3) Connected as voltage follower with  $2V_{PP}$  step input. Number specified is the slower of the positive and negative slew rates.

## 5.5 Shutdown Characteristics 2.7V

$V_+ = 2.7V$ ,  $GND = 0V$ ,  $V_{IC} = V_O = V_+/2$ ,  $R_L > 1M\Omega$  (unless otherwise noted)

| PARAMETER      |                                               | TEST CONDITIONS | $T_A$      | MIN        | TYP        | MAX  | UNIT    |
|----------------|-----------------------------------------------|-----------------|------------|------------|------------|------|---------|
| $I_{CC(SHDN)}$ | Supply current in shutdown mode (per channel) | $V_{SD} = 0V$   | 25°C       |            | 0.045      | 1000 | nA      |
|                |                                               |                 | Full range |            |            | 1.5  | $\mu A$ |
| $t_{(on)}$     | Amplifier turn-on time                        |                 | 25°C       |            | 5          |      | $\mu s$ |
| $V_{SD}$       | Shutdown pin voltage range                    | ON mode         | 25°C       | 1.7 to 2.7 | 2.4 to 2.7 |      | V       |
|                |                                               | Shutdown mode   |            | 0 to 1     | 0 to 0.2   |      |         |

## 5.6 Electrical Characteristics 5V

$V_+ = 5V$ ,  $GND = 0V$ ,  $V_{IC} = V_O = V_+/2$ ,  $R_L > 1M\Omega$  (unless otherwise noted)

| PARAMETER        |                                                         | TEST CONDITIONS                                                                         |            | T <sub>A</sub> | LMV341 |                    |     | LMV344 |                    |     | UNIT    |
|------------------|---------------------------------------------------------|-----------------------------------------------------------------------------------------|------------|----------------|--------|--------------------|-----|--------|--------------------|-----|---------|
|                  |                                                         |                                                                                         |            |                | MIN    | TYP <sup>(1)</sup> | MAX | MIN    | TYP <sup>(1)</sup> | MAX |         |
| V <sub>IO</sub>  | Input offset voltage                                    |                                                                                         |            | 25°C           | 0.25   |                    | 4   | 0.25   |                    | 4   | mV      |
|                  |                                                         |                                                                                         |            | Full range     | 4.5    |                    | 4.5 |        |                    |     |         |
| α <sub>VIO</sub> | Average temperature coefficient of input offset voltage |                                                                                         |            | Full range     | 1.9    |                    |     | 1.9    |                    |     | μV/°C   |
| I <sub>IB</sub>  | Input bias current                                      |                                                                                         |            | 25°C           | 1      | 200                |     | 1      | 200                |     | pA      |
|                  |                                                         |                                                                                         |            | −40°C to 85°C  | 375    |                    | 375 |        |                    |     |         |
|                  |                                                         |                                                                                         |            | −40°C to 125°C | 5      |                    | 5   |        |                    | nA  |         |
| I <sub>IO</sub>  | Input offset current                                    |                                                                                         |            | 25°C           | 6.6    |                    |     | 6.6    |                    |     | fA      |
| CMRR             | Common-mode rejection ratio                             | 0 ≤ V <sub>ICR</sub> ≤ 4V                                                               |            | 25°C           | 46     | 86                 |     | 56     | 86                 |     | dB      |
|                  |                                                         | 0 ≤ V <sub>ICR</sub> ≤ 3.9V                                                             |            | Full range     | 47     |                    |     | 50     |                    |     |         |
| k <sub>SVR</sub> | Supply-voltage rejection ratio                          | 2.7V ≤ V <sub>+</sub> ≤ 5V                                                              |            | 25°C           | 45     | 82                 |     | 65     | 82                 |     | dB      |
|                  |                                                         |                                                                                         |            | Full range     | 44     |                    |     | 60     |                    |     |         |
| V <sub>ICR</sub> | Common-mode input voltage range                         | CMRR ≥ 50dB                                                                             |            | 25°C           | 0      | −0.2 to 4.2        | 4   | 0      | −0.2 to 4.2        | 4   | V       |
| A <sub>V</sub>   | Large-signal voltage gain <sup>(2)</sup>                | R <sub>L</sub> = 10kΩ to 2.5V                                                           |            | 25°C           | 78     | 116                |     | 78     | 116                |     | dB      |
|                  |                                                         |                                                                                         |            | Full range     | 70     |                    |     | 70     |                    |     |         |
|                  |                                                         | R <sub>L</sub> = 2kΩ to 2.5V                                                            |            | 25°C           | 72     | 107                |     | 72     | 107                |     |         |
|                  |                                                         |                                                                                         |            | Full range     | 64     |                    |     | 64     |                    |     |         |
| V <sub>O</sub>   | Output swing (delta from supply rails)                  | R <sub>L</sub> = 2kΩ to 2.5V                                                            | Low level  | 25°C           | 32     | 67                 |     | 32     | 60                 |     | mV      |
|                  |                                                         |                                                                                         |            | Full range     | 95     |                    | 95  |        |                    |     |         |
|                  |                                                         |                                                                                         | High level | 25°C           | 34     | 60                 |     | 34     | 60                 |     |         |
|                  |                                                         |                                                                                         |            | Full range     | 95     |                    | 95  |        |                    |     |         |
|                  |                                                         | R <sub>L</sub> = 10kΩ to 2.5V                                                           | Low level  | 25°C           | 7      | 30                 |     | 7      | 30                 |     |         |
|                  |                                                         |                                                                                         |            | Full range     | 45     |                    | 40  |        |                    |     |         |
|                  |                                                         |                                                                                         | High level | 25°C           | 7      | 30                 |     | 7      | 30                 |     |         |
|                  |                                                         |                                                                                         |            | Full range     | 40     |                    | 40  |        |                    |     |         |
| I <sub>CC</sub>  | Supply current (per channel)                            |                                                                                         |            | 25°C           | 150    | 200                |     | 150    | 200                |     | μA      |
|                  |                                                         |                                                                                         |            | Full range     | 260    |                    | 260 |        |                    |     |         |
| I <sub>OS</sub>  | Output short-circuit current                            | Sourcing                                                                                |            | 25°C           | 85     | 113                |     | 70     | 90                 |     | mA      |
|                  |                                                         | Sinking                                                                                 |            |                | 50     | 75                 |     | 50     | 75                 |     |         |
| SR               | Slew rate                                               | R <sub>L</sub> = 10kΩ <sup>(3)</sup>                                                    |            | 25°C           | 1      |                    |     | 1      |                    |     | V/μs    |
| GBM              | Unity-gain bandwidth                                    | R <sub>L</sub> = 10kΩ, C <sub>L</sub> = 200pF                                           |            | 25°C           | 1      |                    |     | 1      |                    |     | MHz     |
| Φ <sub>m</sub>   | Phase margin                                            | R <sub>L</sub> = 100kΩ                                                                  |            | 25°C           | 70     |                    |     | 70     |                    |     | deg     |
| G <sub>m</sub>   | Gain margin                                             | R <sub>L</sub> = 100kΩ                                                                  |            | 25°C           | 20     |                    |     | 20     |                    |     | dB      |
| V <sub>n</sub>   | Equivalent input noise voltage                          | f = 1kHz                                                                                |            | 25°C           | 39     |                    |     | 39     |                    |     | nV/√ Hz |
| I <sub>n</sub>   | Equivalent input noise current                          | f = 1kHz                                                                                |            | 25°C           | 0.001  |                    |     | 0.001  |                    |     | pA/√ Hz |
| THD              | Total harmonic distortion                               | f = 1kHz, A <sub>V</sub> = 1, R <sub>L</sub> = 600Ω, V <sub>I</sub> = 1 V <sub>PP</sub> |            | 25°C           | 0.012  |                    |     | 0.012  |                    |     | %       |

(1) Typical values represent the most likely parametric norm.

(2)  $GND + 0.2V \leq V_O \leq V_+ - 0.2V$

(3) Connected as voltage follower with  $2V_{PP}$  step input. Number specified is the slower of the positive and negative slew rates.

## 5.7 Shutdown Characteristics 5V

$V_+ = 5V$ ,  $GND = 0V$ ,  $V_{IC} = V_O = V_+/2$ ,  $R_L > 1M\Omega$  (unless otherwise noted)

| PARAMETER      |                                               | TEST CONDITIONS | $T_A$      | MIN | TYP      | MAX      | UNIT    |
|----------------|-----------------------------------------------|-----------------|------------|-----|----------|----------|---------|
| $I_{CC(SHDN)}$ | Supply current in shutdown mode (per channel) | $V_{SD} = 0V$   | 25°C       |     | 0.033    | 1        | $\mu A$ |
|                |                                               |                 | Full range |     |          | 1.5      |         |
| $t_{(on)}$     | Amplifier turn-on time                        |                 | 25°C       |     | 5        |          | $\mu s$ |
| $V_{SD}$       | Shutdown pin voltage range                    | ON mode         | 25°C       |     | 3.1 to 5 | 4.5 to 5 | V       |
|                |                                               | Shutdown mode   |            |     | 0 to 1   | 0 to 0.2 |         |

## 6 Typical Characteristics

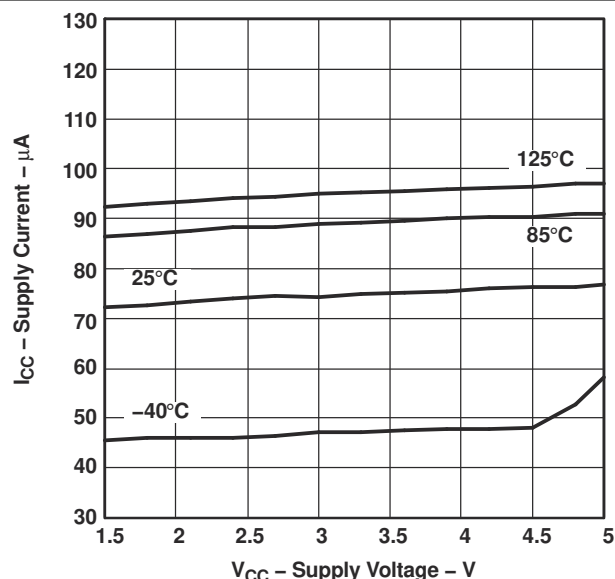


Figure 6-1. Supply Current  
vs  
Supply Voltage

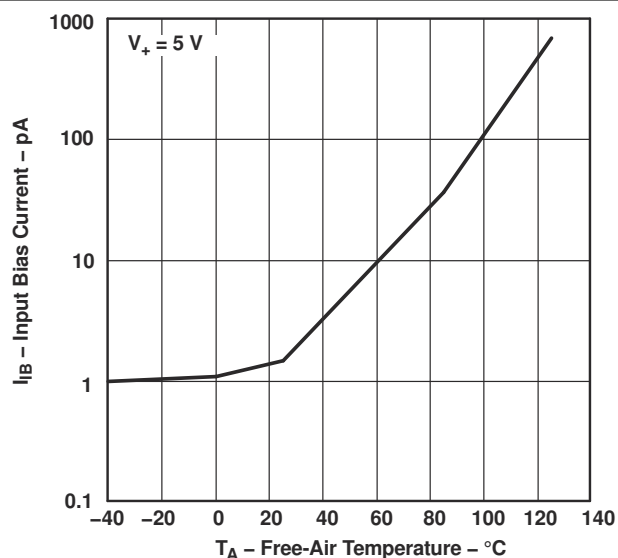


Figure 6-2. Input Bias Current  
vs  
Temperature

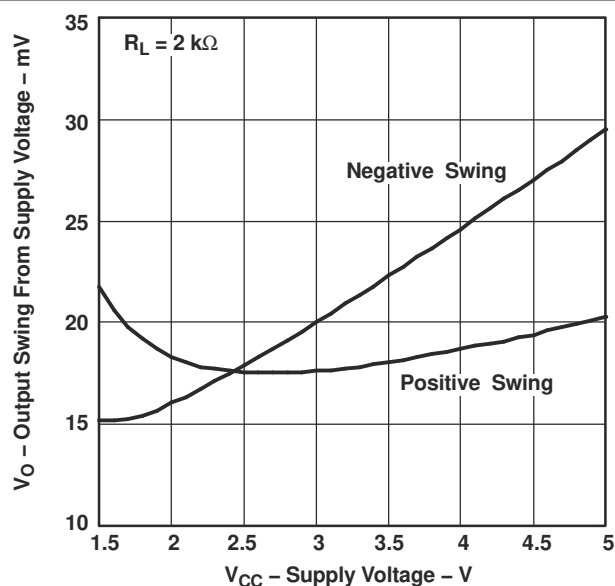


Figure 6-3. Output Voltage Swing  
vs  
Supply Voltage

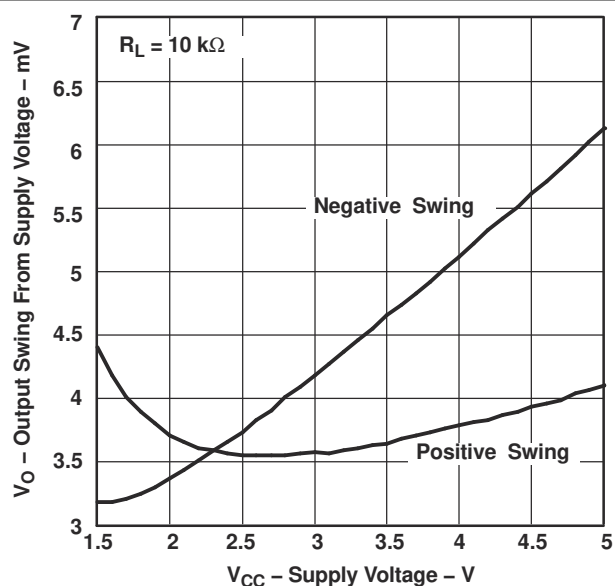
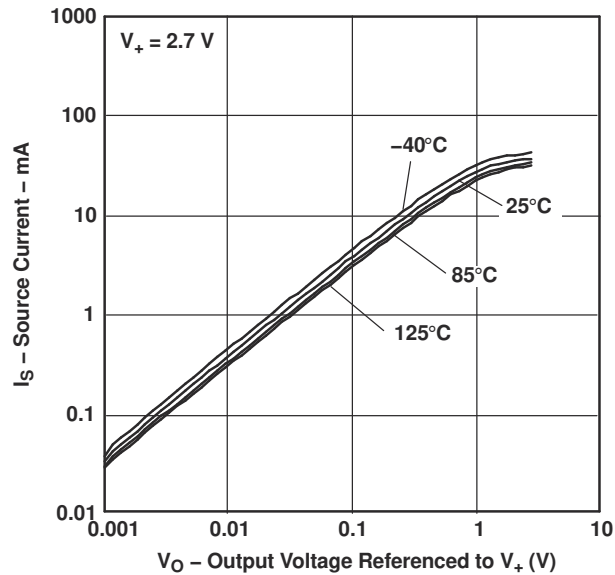
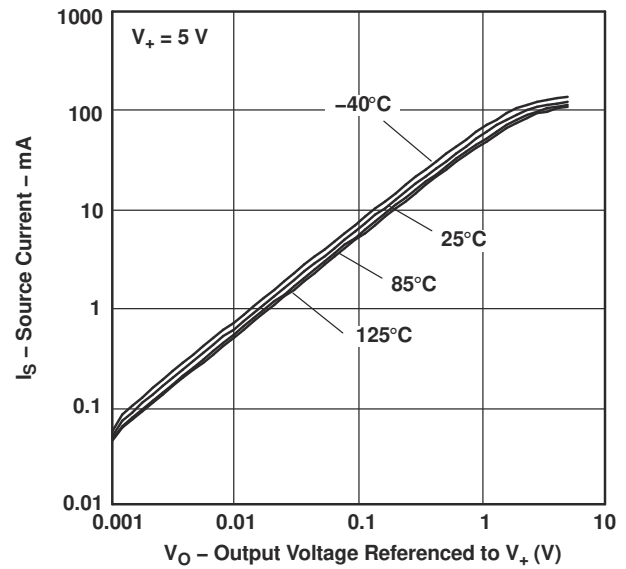


Figure 6-4. Output Voltage Swing  
vs  
Supply Voltage

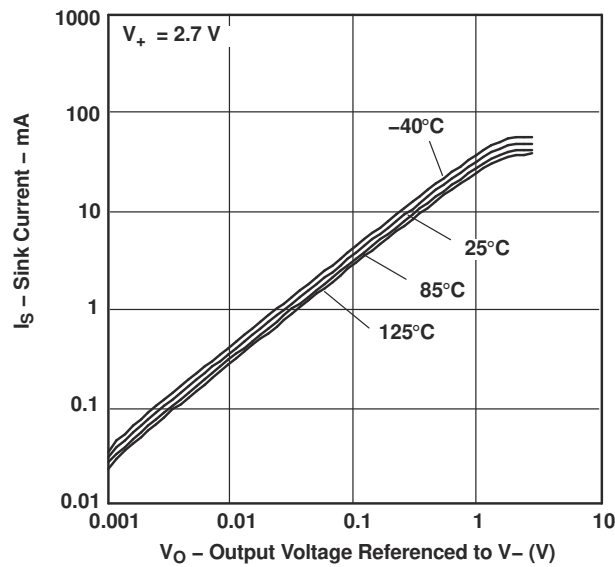
## 6 Typical Characteristics (continued)



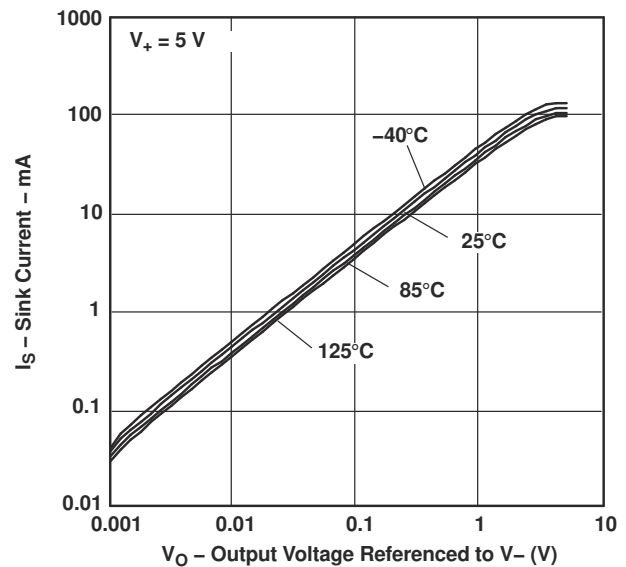
**Figure 6-5. Source Current  
vs  
Output Voltage**



**Figure 6-6. Source Current  
vs  
Output Voltage**

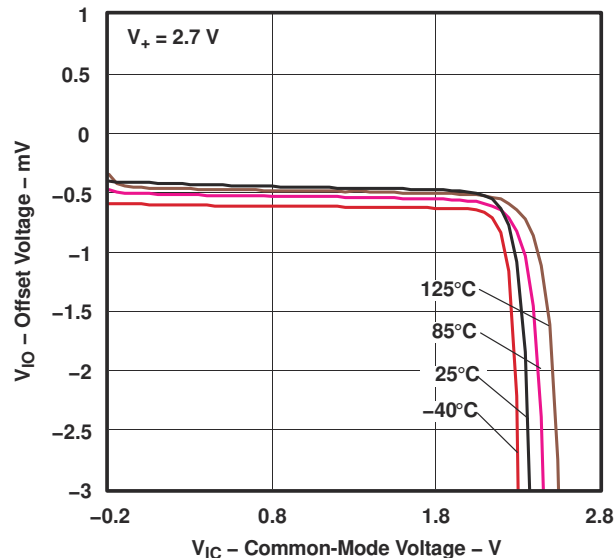


**Figure 6-7. Sink Current  
vs  
Output Voltage**

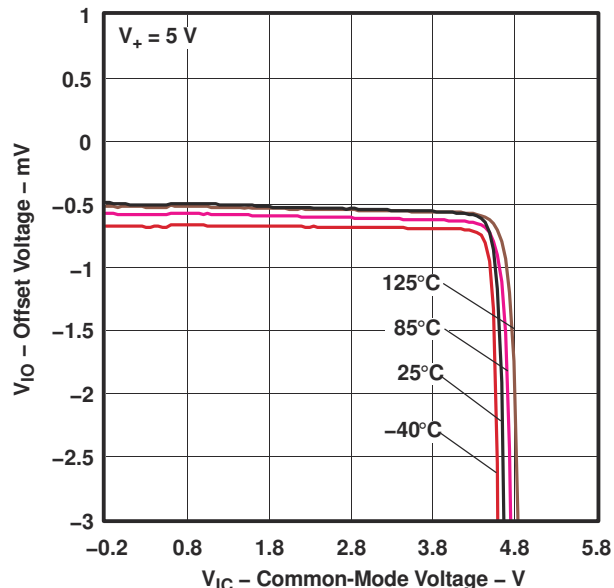


**Figure 6-8. Sink Current  
vs  
Output Voltage**

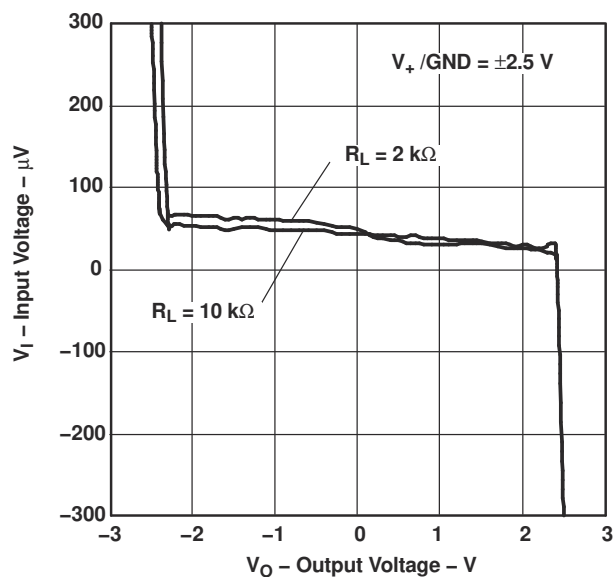
## 6 Typical Characteristics (continued)



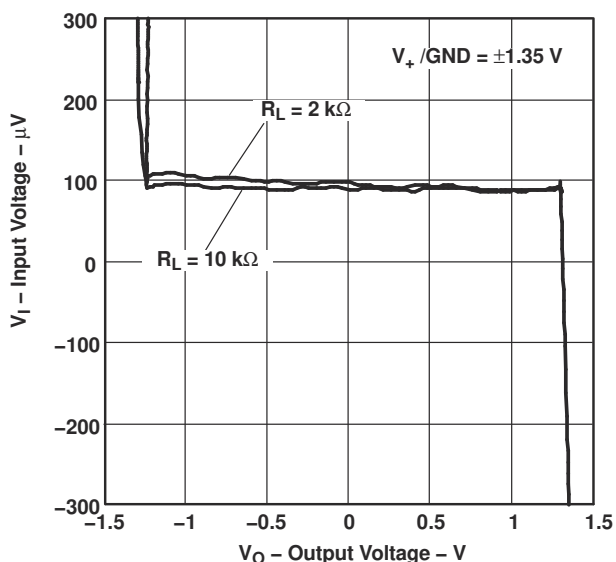
**Figure 6-9. Offset Voltage  
vs  
Common-mode Voltage**



**Figure 6-10. Offset Voltage  
vs  
Common-mode Voltage**



**Figure 6-11. Input Voltage  
vs  
Output Voltage**



**Figure 6-12. Input Voltage  
vs  
Output Voltage**

## 6 Typical Characteristics (continued)

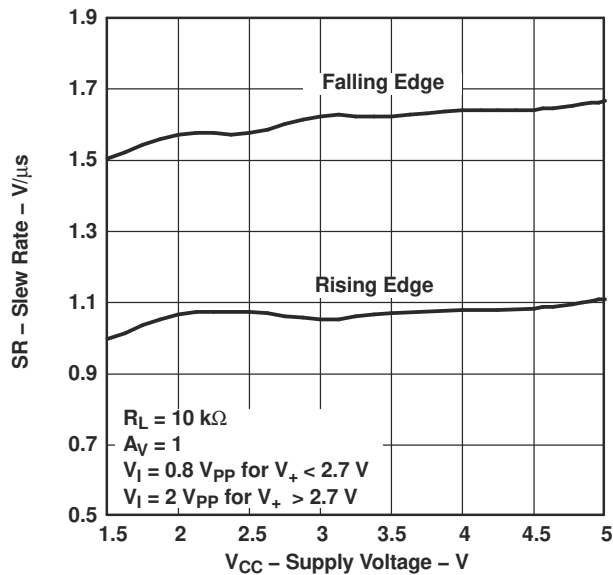


Figure 6-13. Slew Rate  
vs  
Supply Voltage

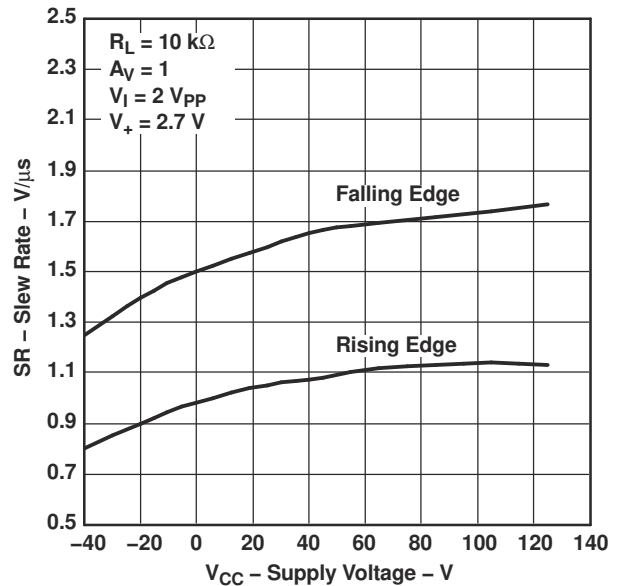


Figure 6-14. Slew Rate  
vs  
Temperature

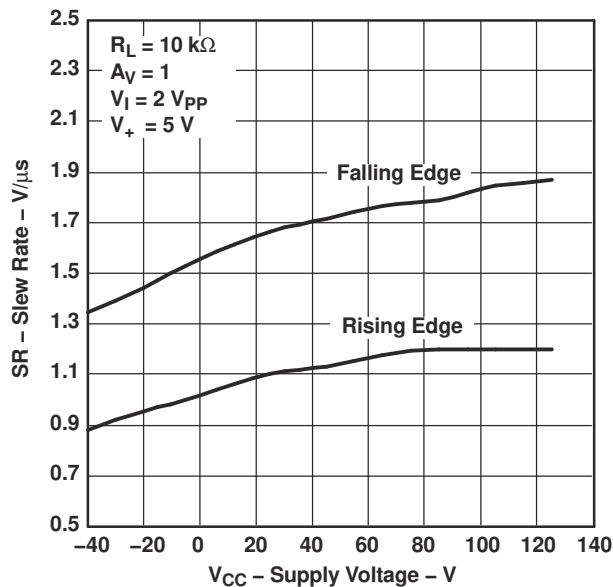


Figure 6-15. Slew Rate  
vs  
Temperature

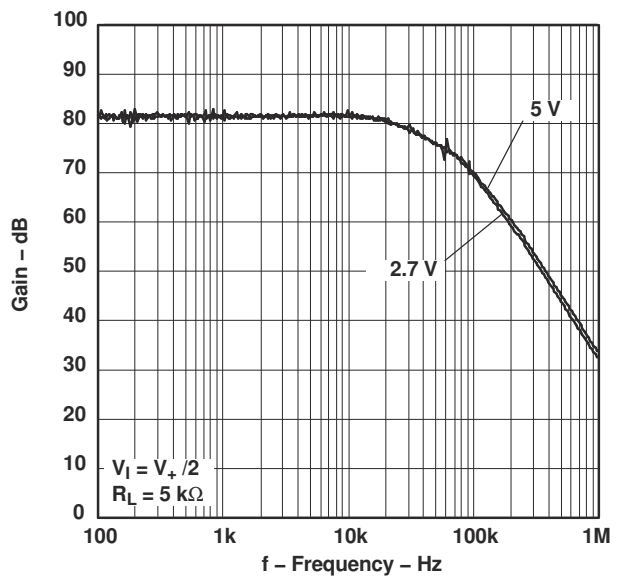


Figure 6-16. Cmr  
vs  
Frequency

## 6 Typical Characteristics (continued)

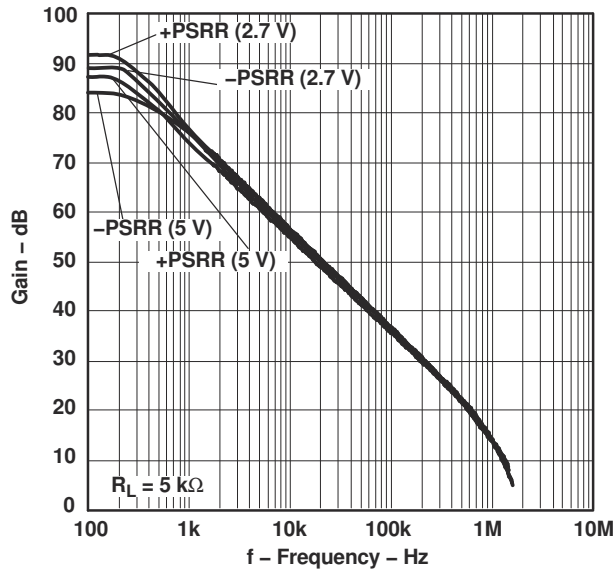


Figure 6-17. Psrr  
vs  
Frequency

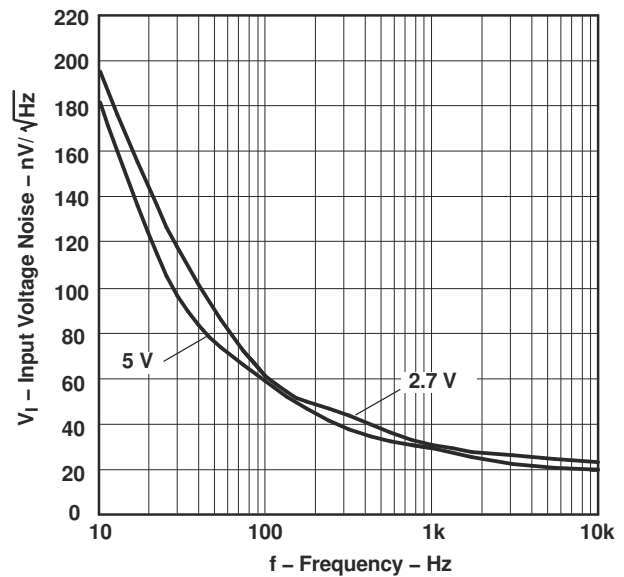


Figure 6-18. Input Voltage Noise  
vs  
Frequency

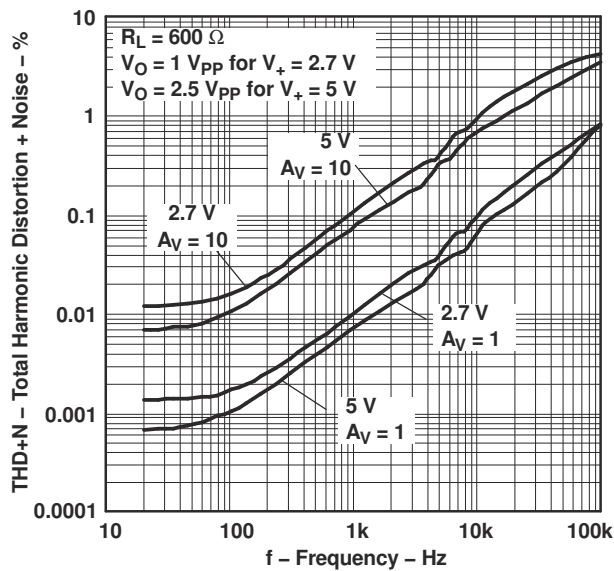


Figure 6-19. Total Harmonic Distortion + Noise  
vs  
Frequency

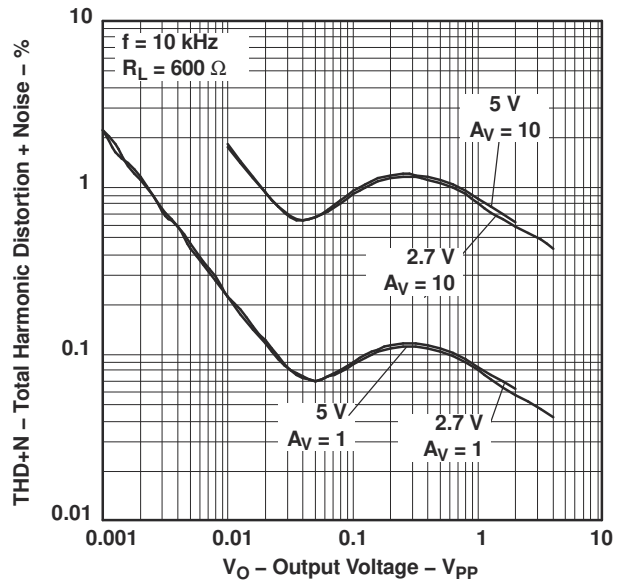
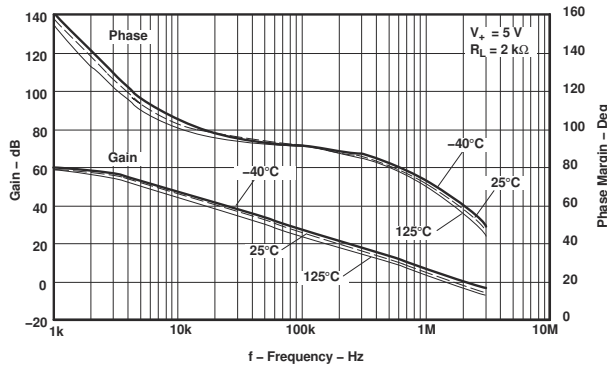
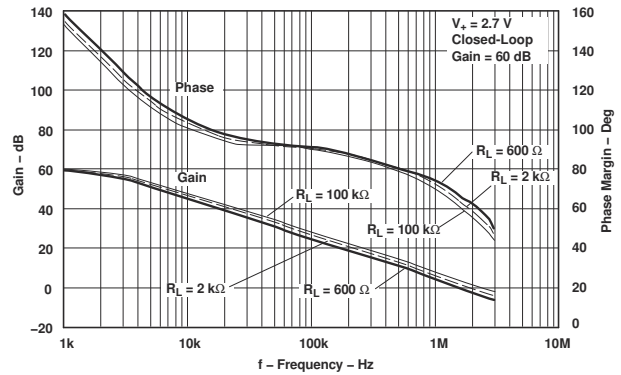


Figure 6-20. Total Harmonic Distortion + Noise  
vs  
Output Voltage

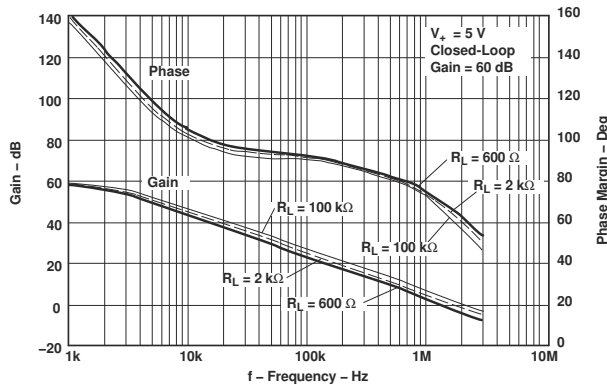
## 6 Typical Characteristics (continued)



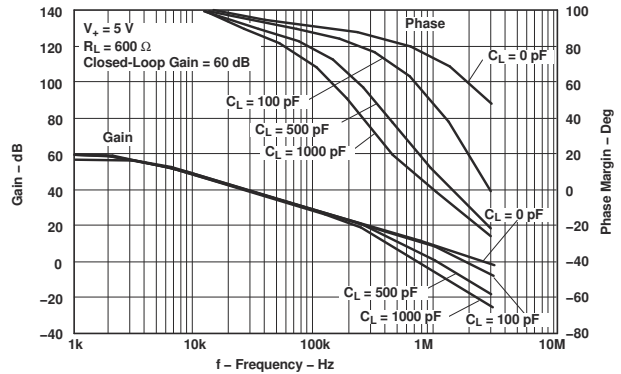
**Figure 6-21. Gain And Phase Margin vs Frequency**  
( $t_a = -40^\circ\text{C}, 25^\circ\text{C}, 125^\circ\text{C}$ )



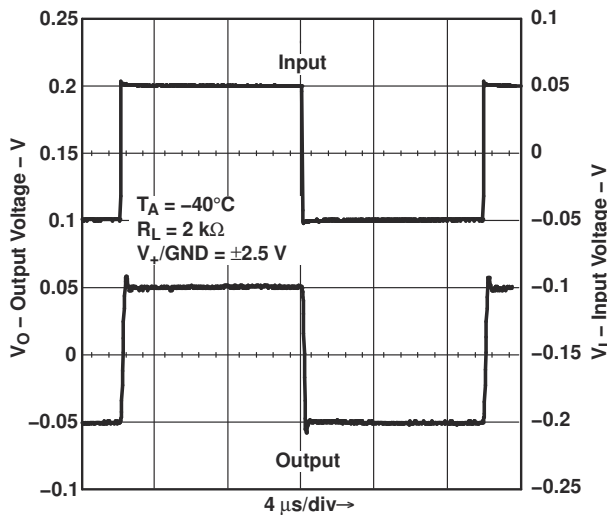
**Figure 6-22. Gain And Phase Margin vs Frequency**  
( $r_l = 600\omega, 2k\omega, 100k\omega$ )



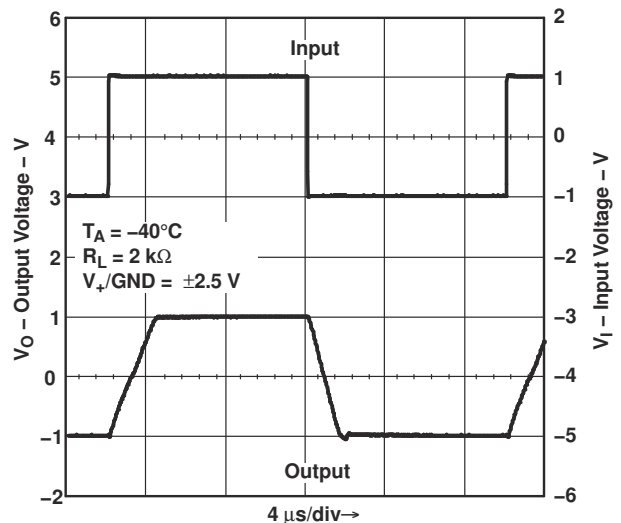
**Figure 6-23. Gain And Phase Margin vs Frequency**  
( $r_l = 600\omega, 2k\omega, 100k\omega$ )



**Figure 6-24. Gain And Phase Margin vs Frequency**  
( $c_l = 0\text{pf}, 100\text{pf}, 500\text{pf}, 1000\text{pf}$ )



**Figure 6-25. Small-Signal Noninverting Response**



**Figure 6-26. Large-Signal Noninverting Response**

## 6 Typical Characteristics (continued)

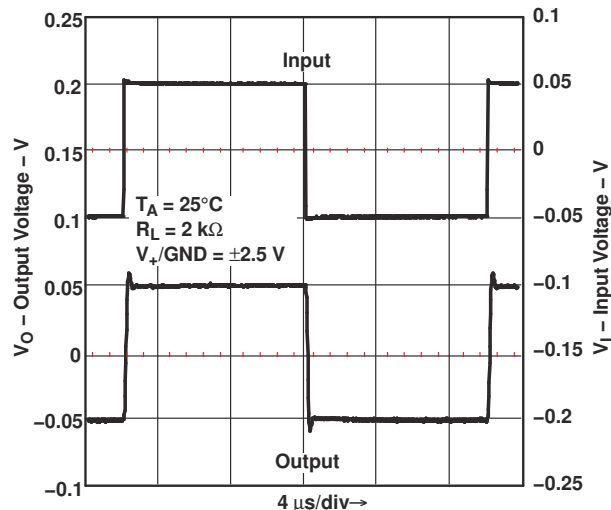


Figure 6-27. Small-Signal Noninverting Response

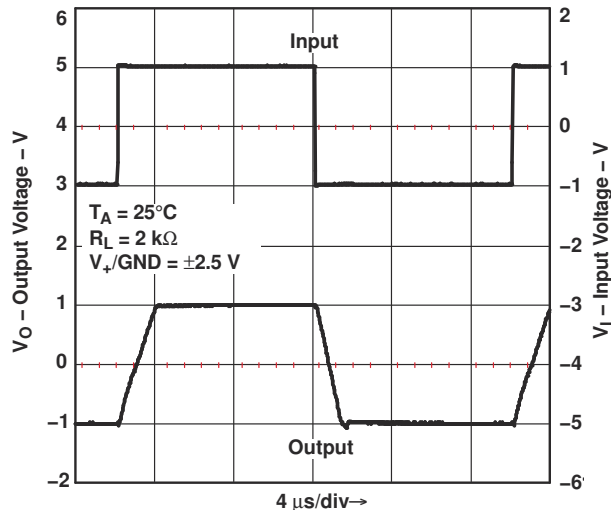


Figure 6-28. Large-Signal Noninverting Response

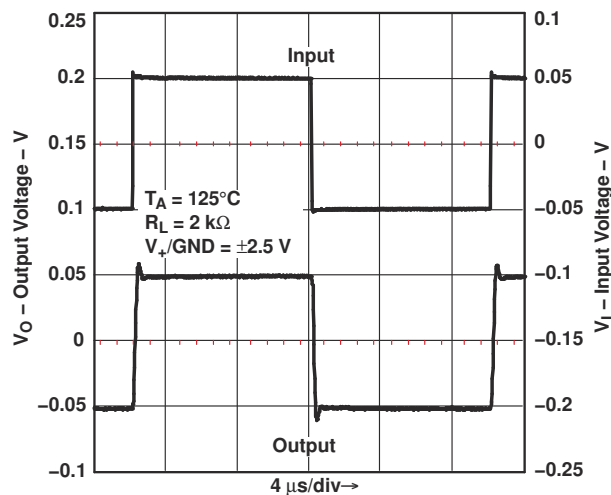


Figure 6-29. Small-Signal Noninverting Response

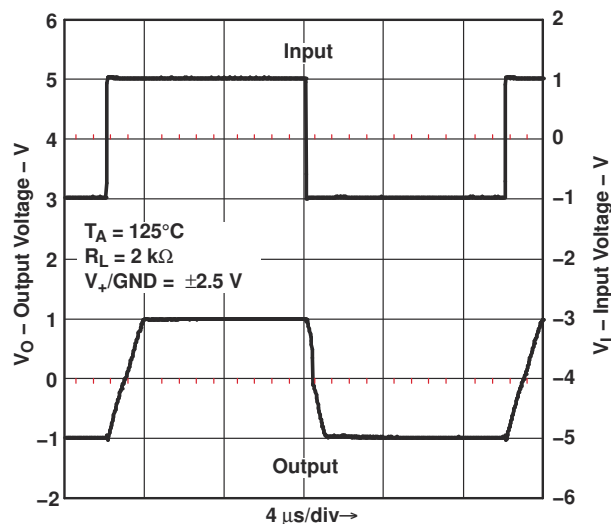


Figure 6-30. Large-Signal Noninverting Response

## 6 Typical Characteristics (continued)

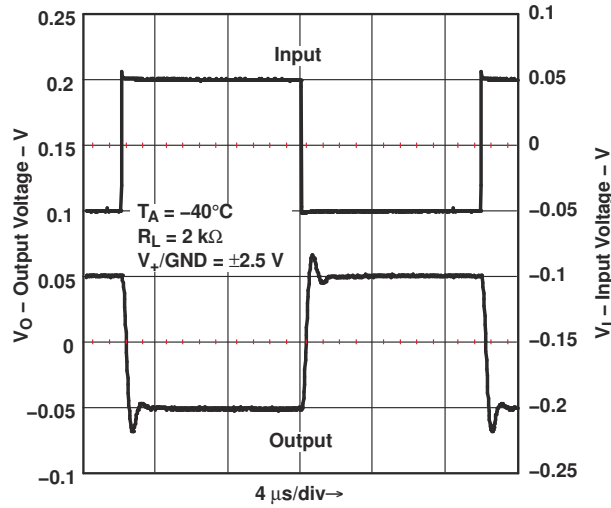


Figure 6-31. Small-Signal Inverting Response

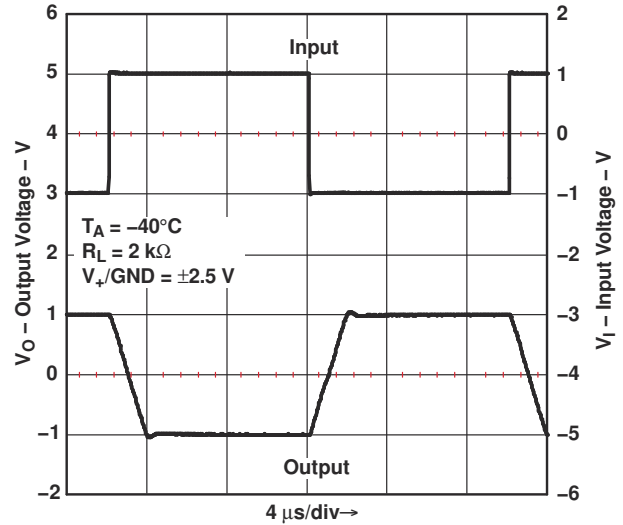


Figure 6-32. Large-Signal Inverting Response

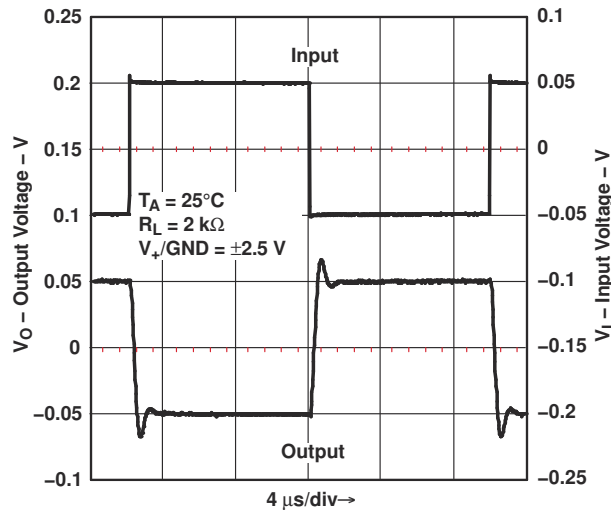


Figure 6-33. Small-Signal Inverting Response

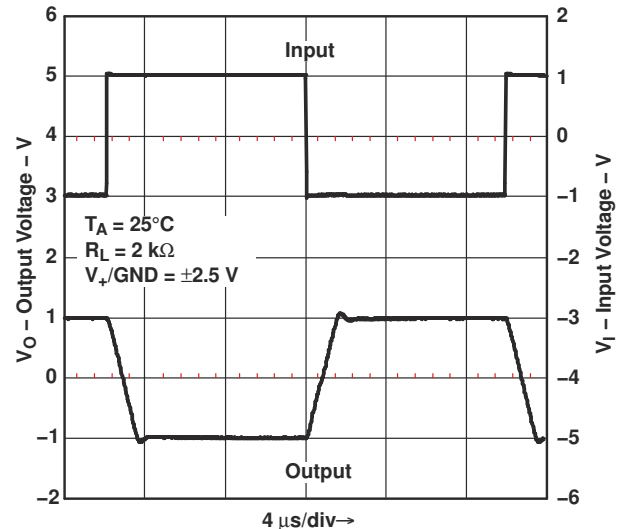


Figure 6-34. Large-Signal Inverting Response

## 6 Typical Characteristics (continued)

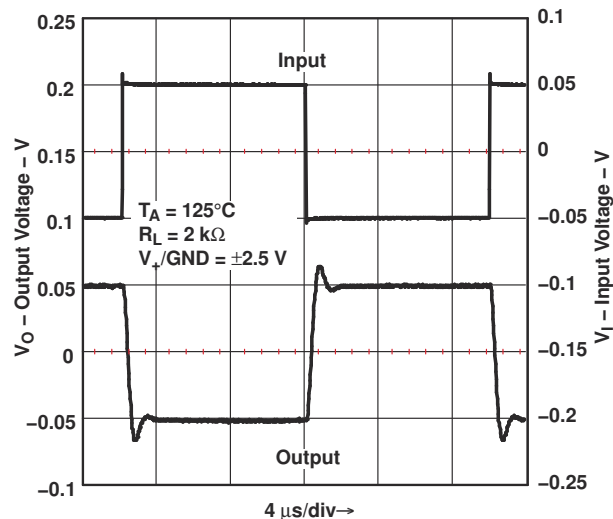


Figure 6-35. Small-Signal Inverting Response

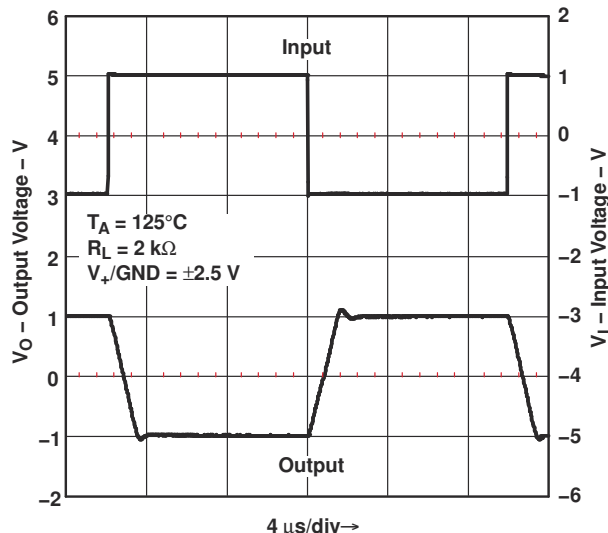


Figure 6-36. Large-Signal Inverting Response

## 7 Device and Documentation Support

### 7.1 Documentation Support

### 7.2 Receiving Notification of Documentation Updates

To receive notification of documentation updates, navigate to the device product folder on [ti.com](http://ti.com). Click on *Notifications* to register and receive a weekly digest of any product information that has changed. For change details, review the revision history included in any revised document.

### 7.3 Support Resources

[TI E2E™ support forums](#) are an engineer's go-to source for fast, verified answers and design help — straight from the experts. Search existing answers or ask your own question to get the quick design help you need.

Linked content is provided "AS IS" by the respective contributors. They do not constitute TI specifications and do not necessarily reflect TI's views; see TI's [Terms of Use](#).

### 7.4 Trademarks

TI E2E™ is a trademark of Texas Instruments.

All trademarks are the property of their respective owners.

### 7.5 Electrostatic Discharge Caution



This integrated circuit can be damaged by ESD. Texas Instruments recommends that all integrated circuits be handled with appropriate precautions. Failure to observe proper handling and installation procedures can cause damage.

ESD damage can range from subtle performance degradation to complete device failure. Precision integrated circuits may be more susceptible to damage because very small parametric changes could cause the device not to meet its published specifications.

### 7.6 Glossary

[TI Glossary](#) This glossary lists and explains terms, acronyms, and definitions.

## 8 Revision History

NOTE: Page numbers for previous revisions may differ from page numbers in the current version.

| Changes from Revision C (June 2009) to Revision D (July 2025)                                                                                | Page |
|----------------------------------------------------------------------------------------------------------------------------------------------|------|
| • Updated the numbering format for tables, figures, and cross-references throughout the document.....                                        | 1    |
| • Changed supply current per channel specification at V+ = 2.7V from 100µA to 150µA (typical) and from 170µA to 200µA (maximum at 25°C)..... | 6    |
| • Changed recommended shutdown pin voltage range, shutdown mode specification at V+ = 2.7V from 0 to 0.8V to 0 to 0.2V (maximum).....        | 7    |
| • Changed supply current per channel specification at V+ = 5V from 100µA to 150µA (typical).....                                             | 8    |
| • Changed recommended shutdown pin voltage range, shutdown mode specification at V+ = 5V from 0 to 0.8V to 0 to 0.2V (maximum).....          | 9    |

## 9 Mechanical, Packaging, and Orderable Information

The following pages include mechanical, packaging, and orderable information. This information is the most current data available for the designated devices. This data is subject to change without notice and revision of this document. For browser-based versions of this data sheet, refer to the left-hand navigation.

## PACKAGING INFORMATION

| Orderable part number           | Status<br>(1) | Material type<br>(2) | Package   Pins   | Package qty   Carrier | RoHS<br>(3) | Lead finish/<br>Ball material<br>(4) | MSL rating/<br>Peak reflow<br>(5) | Op temp (°C) | Part marking<br>(6) |
|---------------------------------|---------------|----------------------|------------------|-----------------------|-------------|--------------------------------------|-----------------------------------|--------------|---------------------|
| <a href="#">LMV341QDBVRQ1</a>   | Active        | Production           | SOT-23 (DBV)   6 | 3000   LARGE T&R      | Yes         | NIPDAU                               | Level-1-260C-UNLIM                | -40 to 125   | RCHE                |
| LMV341QDBVRQ1.A                 | Active        | Production           | SOT-23 (DBV)   6 | 3000   LARGE T&R      | Yes         | NIPDAU                               | Level-1-260C-UNLIM                | -40 to 125   | RCHE                |
| <a href="#">LMV341QDCKRQ1</a>   | Active        | Production           | SC70 (DCK)   6   | 3000   LARGE T&R      | Yes         | NIPDAU                               | Level-1-260C-UNLIM                | -40 to 125   | RRE                 |
| LMV341QDCKRQ1.A                 | Active        | Production           | SC70 (DCK)   6   | 3000   LARGE T&R      | Yes         | NIPDAU                               | Level-1-260C-UNLIM                | -40 to 125   | RRE                 |
| <a href="#">LMV341QDCKRQ1G4</a> | Active        | Production           | SC70 (DCK)   6   | 3000   LARGE T&R      | Yes         | NIPDAU                               | Level-1-260C-UNLIM                | -40 to 125   | (R4E, RRE)          |
| LMV341QDCKRQ1G4.A               | Active        | Production           | SC70 (DCK)   6   | 3000   LARGE T&R      | Yes         | NIPDAU                               | Level-1-260C-UNLIM                | -40 to 125   | (R4E, RRE)          |
| <a href="#">LMV344IPWRQ1</a>    | Active        | Production           | TSSOP (PW)   14  | 2000   LARGE T&R      | Yes         | NIPDAU                               | Level-1-260C-UNLIM                | -40 to 125   | LMV344Q             |
| LMV344IPWRQ1.A                  | Active        | Production           | TSSOP (PW)   14  | 2000   LARGE T&R      | Yes         | NIPDAU                               | Level-1-260C-UNLIM                | -40 to 125   | LMV344Q             |

<sup>(1)</sup> **Status:** For more details on status, see our [product life cycle](#).

<sup>(2)</sup> **Material type:** When designated, preproduction parts are prototypes/experimental devices, and are not yet approved or released for full production. Testing and final process, including without limitation quality assurance, reliability performance testing, and/or process qualification, may not yet be complete, and this item is subject to further changes or possible discontinuation. If available for ordering, purchases will be subject to an additional waiver at checkout, and are intended for early internal evaluation purposes only. These items are sold without warranties of any kind.

<sup>(3)</sup> **RoHS values:** Yes, No, RoHS Exempt. See the [TI RoHS Statement](#) for additional information and value definition.

<sup>(4)</sup> **Lead finish/Ball material:** Parts may have multiple material finish options. Finish options are separated by a vertical ruled line. Lead finish/Ball material values may wrap to two lines if the finish value exceeds the maximum column width.

<sup>(5)</sup> **MSL rating/Peak reflow:** The moisture sensitivity level ratings and peak solder (reflow) temperatures. In the event that a part has multiple moisture sensitivity ratings, only the lowest level per JEDEC standards is shown. Refer to the shipping label for the actual reflow temperature that will be used to mount the part to the printed circuit board.

<sup>(6)</sup> **Part marking:** There may be an additional marking, which relates to the logo, the lot trace code information, or the environmental category of the part.

Multiple part markings will be inside parentheses. Only one part marking contained in parentheses and separated by a "~" will appear on a part. If a line is indented then it is a continuation of the previous line and the two combined represent the entire part marking for that device.

**Important Information and Disclaimer:** The information provided on this page represents TI's knowledge and belief as of the date that it is provided. TI bases its knowledge and belief on information provided by third parties, and makes no representation or warranty as to the accuracy of such information. Efforts are underway to better integrate information from third parties. TI has taken and continues to take reasonable steps to provide representative and accurate information but may not have conducted destructive testing or chemical analysis on incoming materials and chemicals. TI and TI suppliers consider certain information to be proprietary, and thus CAS numbers and other limited information may not be available for release.

In no event shall TI's liability arising out of such information exceed the total purchase price of the TI part(s) at issue in this document sold by TI to Customer on an annual basis.

**OTHER QUALIFIED VERSIONS OF LMV341-Q1, LMV344-Q1 :**

- Catalog : [LMV341](#), [LMV344](#)

NOTE: Qualified Version Definitions:

- Catalog - TI's standard catalog product

## TAPE AND REEL INFORMATION



\*All dimensions are nominal

| Device          | Package Type | Package Drawing | Pins | SPQ  | Reel Diameter (mm) | Reel Width W1 (mm) | A0 (mm) | B0 (mm) | K0 (mm) | P1 (mm) | W (mm) | Pin1 Quadrant |
|-----------------|--------------|-----------------|------|------|--------------------|--------------------|---------|---------|---------|---------|--------|---------------|
| LMV341QDBVRQ1   | SOT-23       | DBV             | 6    | 3000 | 180.0              | 8.4                | 3.2     | 3.2     | 1.4     | 4.0     | 8.0    | Q3            |
| LMV341QDBVRQ1   | SOT-23       | DBV             | 6    | 3000 | 179.0              | 8.4                | 3.2     | 3.2     | 1.4     | 4.0     | 8.0    | Q3            |
| LMV341QDCKRQ1   | SC70         | DCK             | 6    | 3000 | 178.0              | 9.0                | 2.4     | 2.5     | 1.2     | 4.0     | 8.0    | Q3            |
| LMV341QDCKRQ1G4 | SC70         | DCK             | 6    | 3000 | 179.0              | 8.4                | 2.2     | 2.5     | 1.2     | 4.0     | 8.0    | Q3            |
| LMV341QDCKRQ1G4 | SC70         | DCK             | 6    | 3000 | 178.0              | 9.0                | 2.4     | 2.5     | 1.2     | 4.0     | 8.0    | Q3            |
| LMV344IPWRQ1    | TSSOP        | PW              | 14   | 2000 | 330.0              | 12.4               | 6.9     | 5.6     | 1.6     | 8.0     | 12.0   | Q1            |

## TAPE AND REEL BOX DIMENSIONS

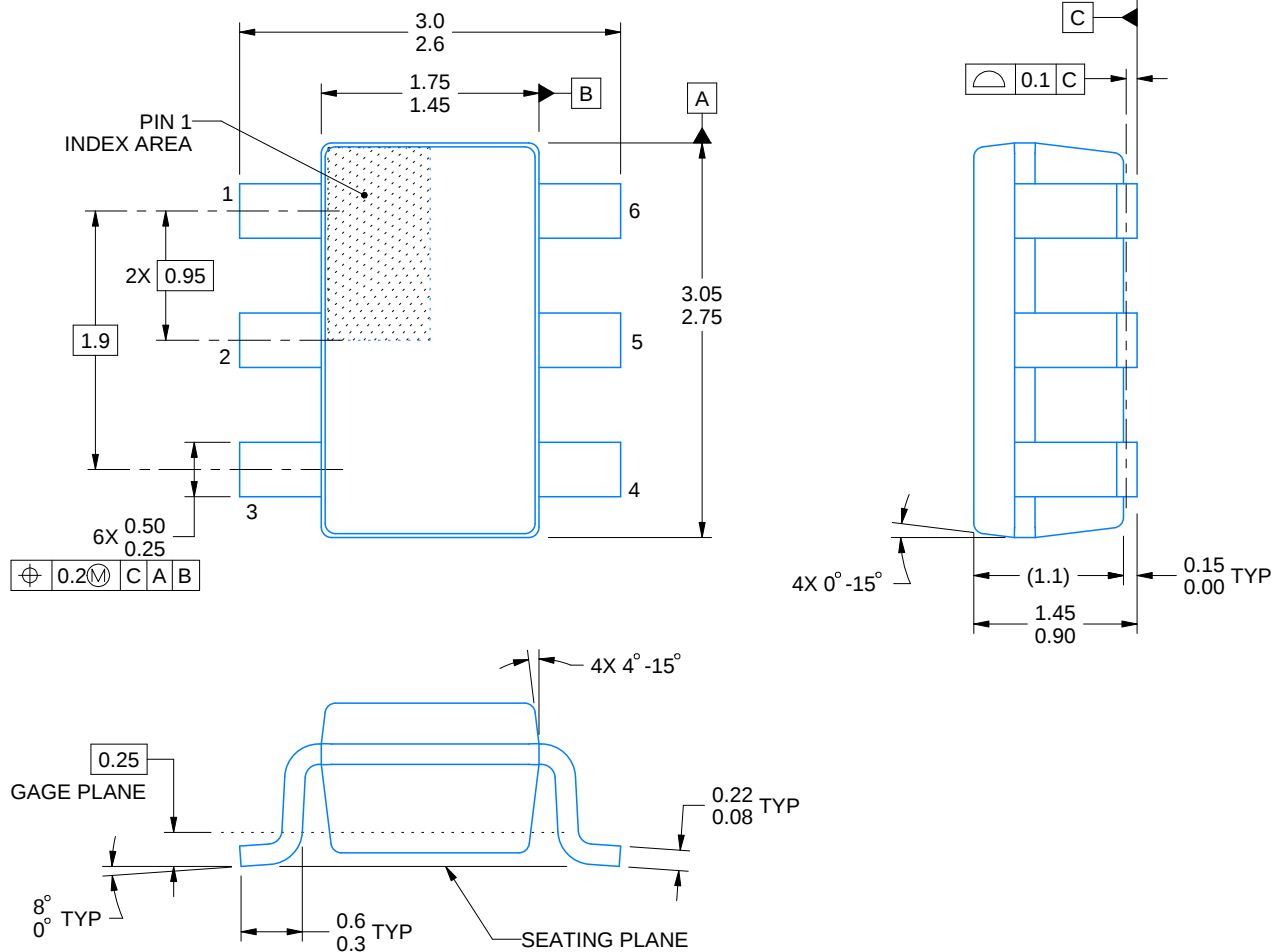


\*All dimensions are nominal

| Device          | Package Type | Package Drawing | Pins | SPQ  | Length (mm) | Width (mm) | Height (mm) |
|-----------------|--------------|-----------------|------|------|-------------|------------|-------------|
| LMV341QDBVRQ1   | SOT-23       | DBV             | 6    | 3000 | 210.0       | 185.0      | 35.0        |
| LMV341QDBVRQ1   | SOT-23       | DBV             | 6    | 3000 | 200.0       | 183.0      | 25.0        |
| LMV341QDCKRQ1   | SC70         | DCK             | 6    | 3000 | 180.0       | 180.0      | 18.0        |
| LMV341QDCKRQ1G4 | SC70         | DCK             | 6    | 3000 | 200.0       | 183.0      | 25.0        |
| LMV341QDCKRQ1G4 | SC70         | DCK             | 6    | 3000 | 180.0       | 180.0      | 18.0        |
| LMV344IPWRQ1    | TSSOP        | PW              | 14   | 2000 | 353.0       | 353.0      | 32.0        |

**DBV0006A****PACKAGE OUTLINE****SOT-23 - 1.45 mm max height**

SMALL OUTLINE TRANSISTOR



4214840/G 08/2024

**NOTES:**

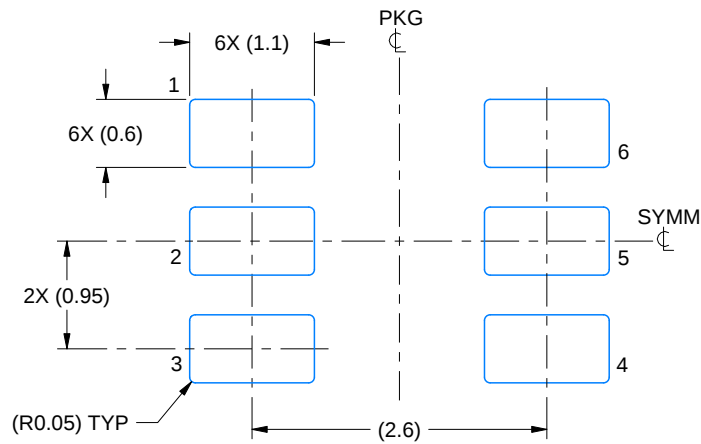
1. All linear dimensions are in millimeters. Any dimensions in parenthesis are for reference only. Dimensioning and tolerancing per ASME Y14.5M.
2. This drawing is subject to change without notice.
3. Body dimensions do not include mold flash or protrusion. Mold flash and protrusion shall not exceed 0.25 per side.
4. Leads 1,2,3 may be wider than leads 4,5,6 for package orientation.
5. Reference JEDEC MO-178.

# EXAMPLE BOARD LAYOUT

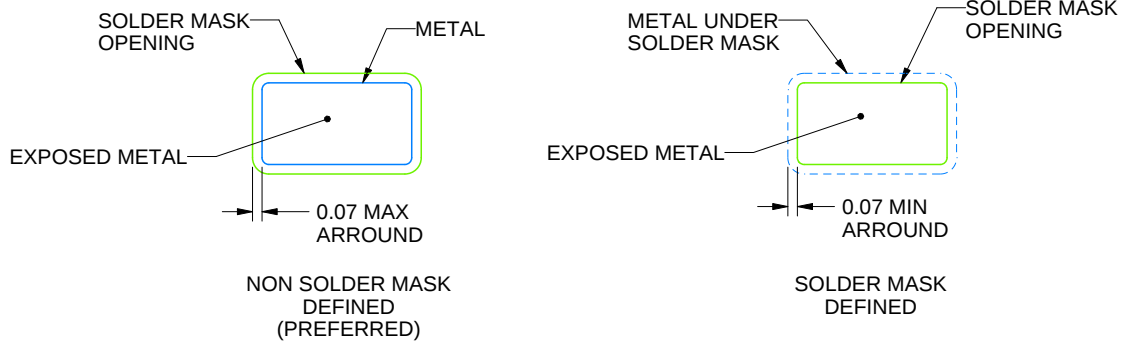
DBV0006A

SOT-23 - 1.45 mm max height

SMALL OUTLINE TRANSISTOR



LAND PATTERN EXAMPLE  
EXPOSED METAL SHOWN  
SCALE:15X



SOLDER MASK DETAILS

4214840/G 08/2024

NOTES: (continued)

6. Publication IPC-7351 may have alternate designs.

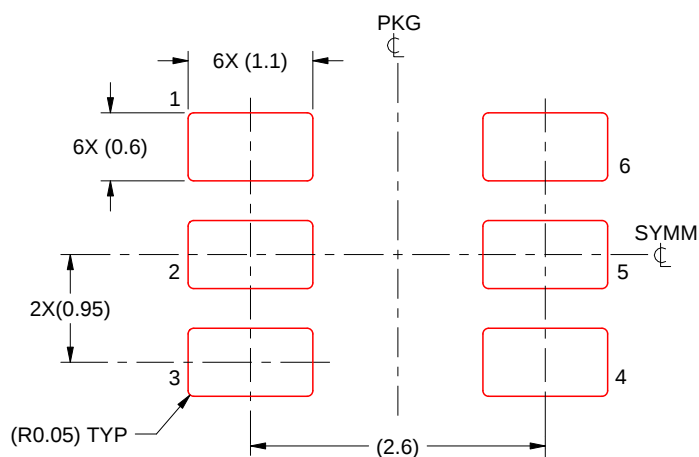
7. Solder mask tolerances between and around signal pads can vary based on board fabrication site.

## EXAMPLE STENCIL DESIGN

DBV0006A

SOT-23 - 1.45 mm max height

SMALL OUTLINE TRANSISTOR



SOLDER PASTE EXAMPLE  
BASED ON 0.125 mm THICK STENCIL  
SCALE:15X

4214840/G 08/2024

NOTES: (continued)

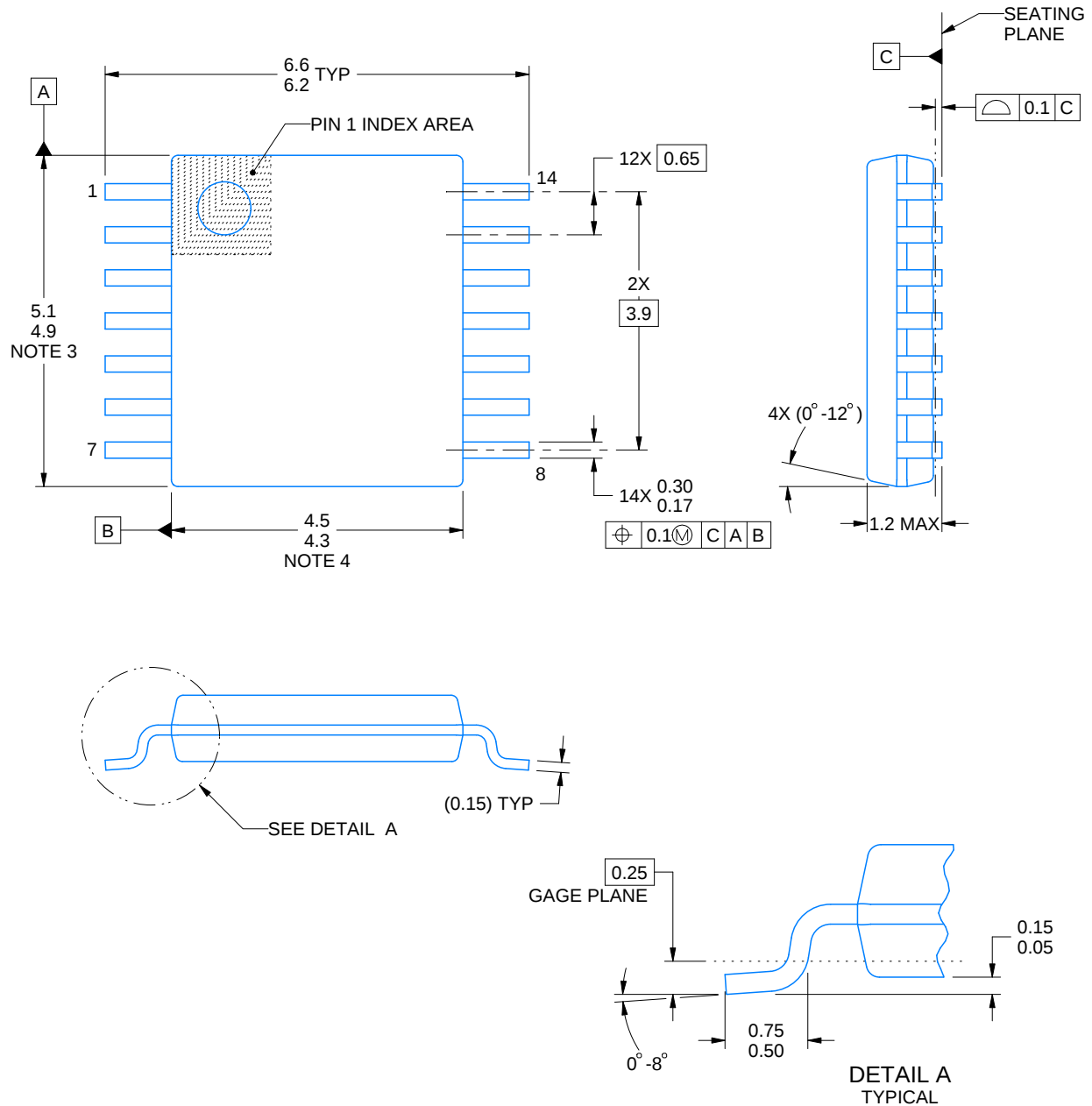
8. Laser cutting apertures with trapezoidal walls and rounded corners may offer better paste release. IPC-7525 may have alternate design recommendations.
9. Board assembly site may have different recommendations for stencil design.

**PW0014A**

## PACKAGE OUTLINE

**TSSOP - 1.2 mm max height**

SMALL OUTLINE PACKAGE



4220202/B 12/2023

NOTES:

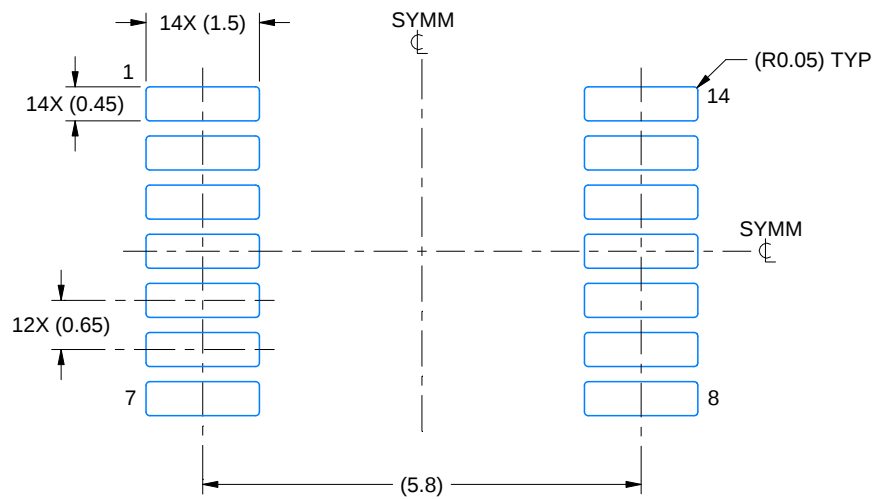
1. All linear dimensions are in millimeters. Any dimensions in parenthesis are for reference only. Dimensioning and tolerancing per ASME Y14.5M.
2. This drawing is subject to change without notice.
3. This dimension does not include mold flash, protrusions, or gate burrs. Mold flash, protrusions, or gate burrs shall not exceed 0.15 mm per side.
4. This dimension does not include interlead flash. Interlead flash shall not exceed 0.25 mm per side.
5. Reference JEDEC registration MO-153.

# EXAMPLE BOARD LAYOUT

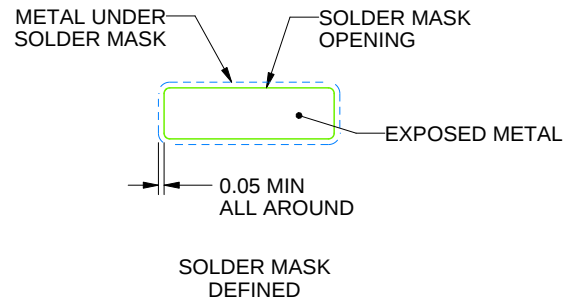
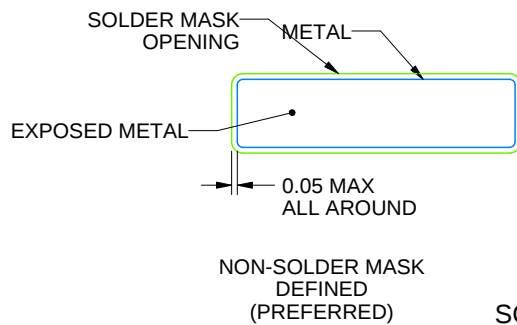
PW0014A

TSSOP - 1.2 mm max height

SMALL OUTLINE PACKAGE



LAND PATTERN EXAMPLE  
EXPOSED METAL SHOWN  
SCALE: 10X



SOLDER MASK DETAILS

4220202/B 12/2023

NOTES: (continued)

6. Publication IPC-7351 may have alternate designs.

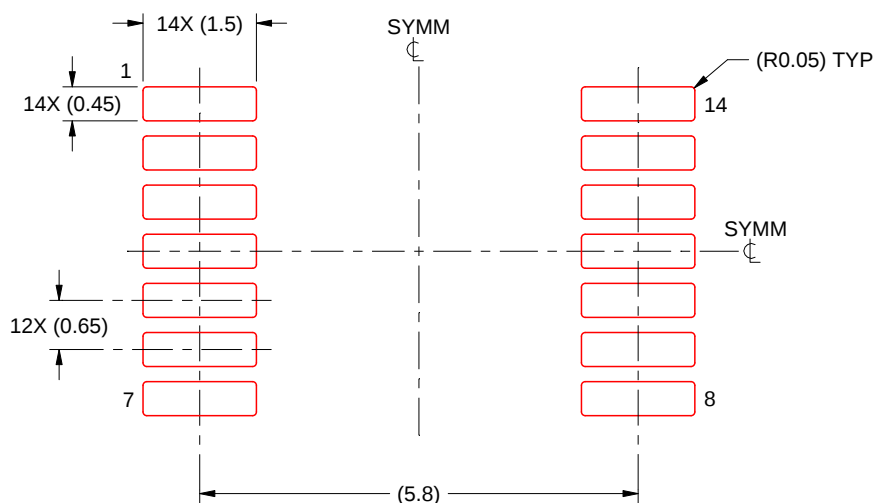
7. Solder mask tolerances between and around signal pads can vary based on board fabrication site.

# EXAMPLE STENCIL DESIGN

PW0014A

TSSOP - 1.2 mm max height

SMALL OUTLINE PACKAGE

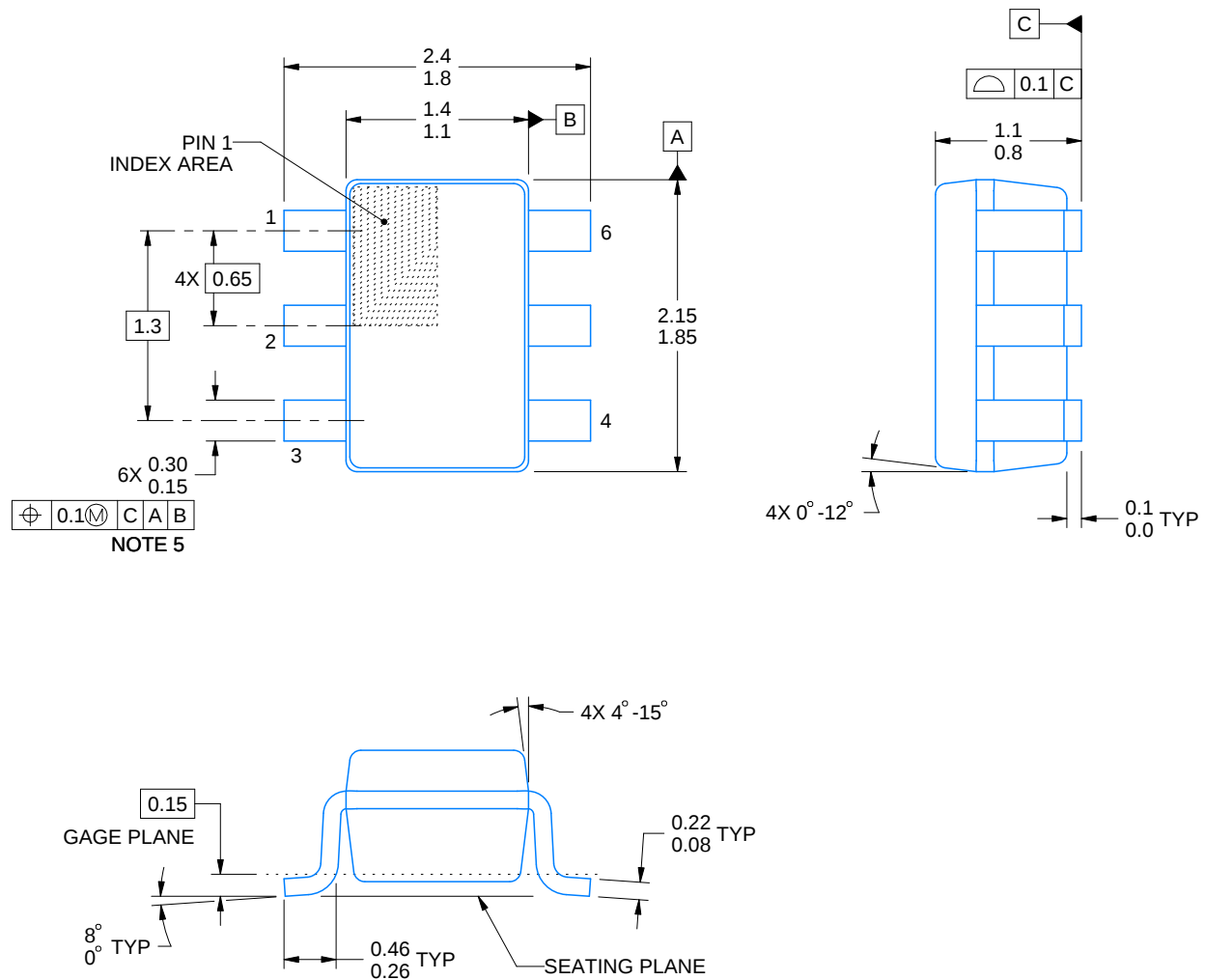


SOLDER PASTE EXAMPLE  
BASED ON 0.125 mm THICK STENCIL  
SCALE: 10X

4220202/B 12/2023

NOTES: (continued)

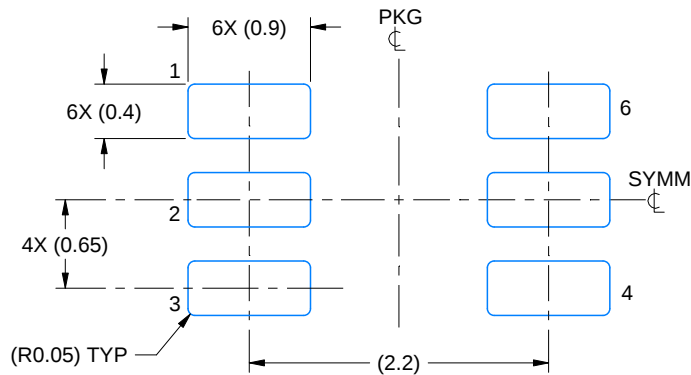
8. Laser cutting apertures with trapezoidal walls and rounded corners may offer better paste release. IPC-7525 may have alternate design recommendations.
9. Board assembly site may have different recommendations for stencil design.



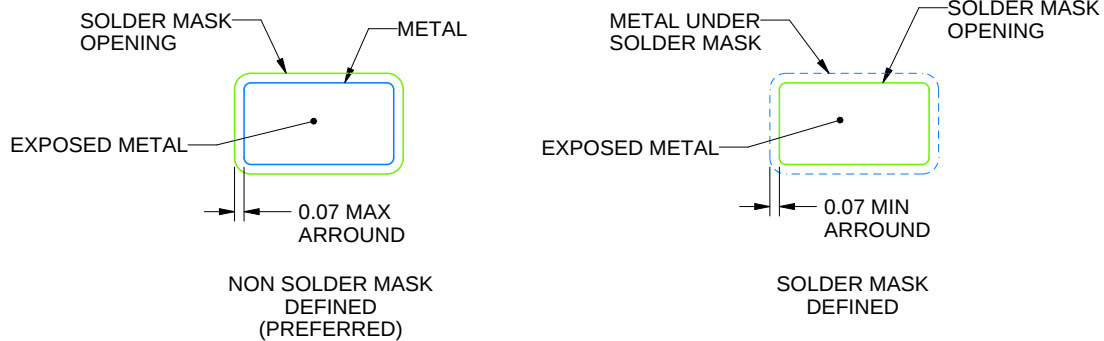
4214835/D 11/2024

## NOTES:

1. All linear dimensions are in millimeters. Any dimensions in parenthesis are for reference only. Dimensioning and tolerancing per ASME Y14.5M.
2. This drawing is subject to change without notice.
3. Body dimensions do not include mold flash or protrusion. Mold flash and protrusion shall not exceed 0.15 per side.
4. Falls within JEDEC MO-203 variation AB.



LAND PATTERN EXAMPLE  
EXPOSED METAL SHOWN  
SCALE:18X

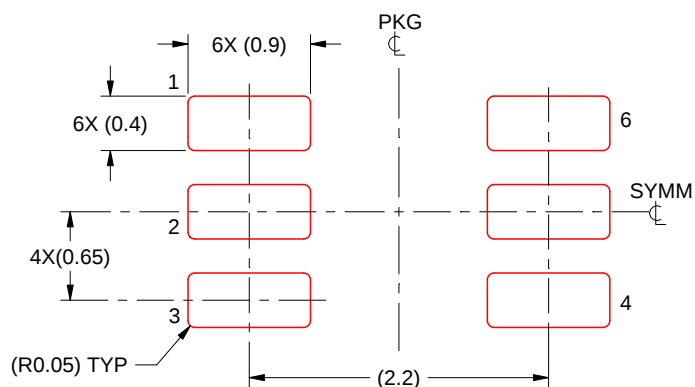


SOLDER MASK DETAILS

4214835/D 11/2024

NOTES: (continued)

5. Publication IPC-7351 may have alternate designs.
6. Solder mask tolerances between and around signal pads can vary based on board fabrication site.



SOLDER PASTE EXAMPLE  
 BASED ON 0.125 THICK STENCIL  
 SCALE:18X

4214835/D 11/2024

NOTES: (continued)

7. Laser cutting apertures with trapezoidal walls and rounded corners may offer better paste release. IPC-7525 may have alternate design recommendations.
8. Board assembly site may have different recommendations for stencil design.

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